Policy needs for BECCS: A cost effective analysis

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- Since CO_2 from biomass transformation is considered neutral, traditional environmental policy instruments, such as environmental taxes, are not appropriate for this technology
- In the Kyoto framework, CO_2 emissions are accounted for in different ways depending on their origin
- Thus, there are currently no incentives for a firm to capture and store CO_2 from biomass

Objectives

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- Compare quantitatively the cost-efficiency of those instruments. Does the instrument attain the environmental target at least cost?

  $\Rightarrow$ 2 criteria: technologies adoption criteria / cost-efficiency criteria

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  - A carbon tax where tax' revenues are recycled to subsidize biomass emissions captured with CCS.

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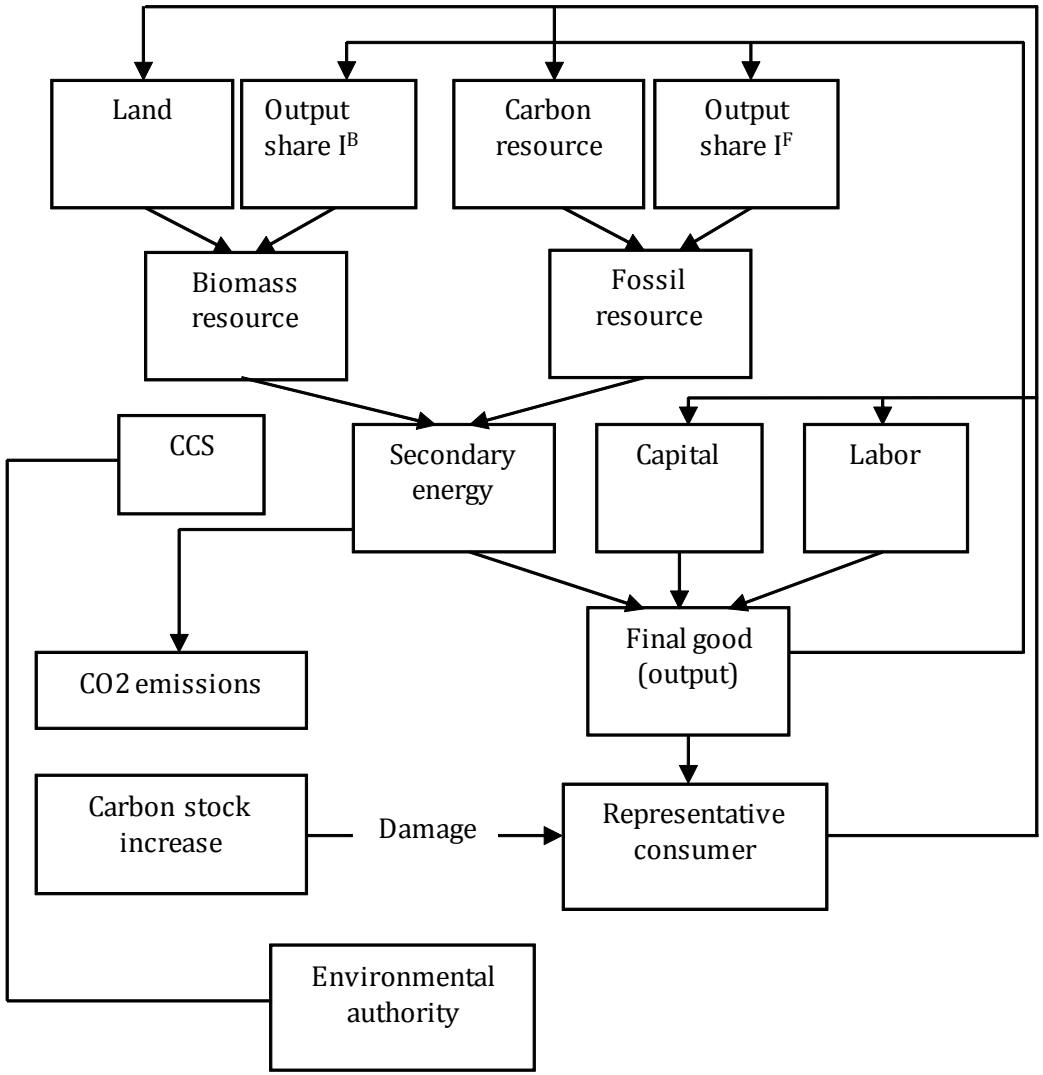
- Standard tool for assessing economy-wide impacts of environmental and technological policies.
- A general equilibium approach offers a comprehensive representation of price dependant market interactions based on Walrasian equilibrium theory
- We study the equilibrium in a decentralized economy; it allows us to examine how the economy reacts to environmental policy changes.

Model structure



Scenarios

Emissions target: a decrease of 20% in total emissions from the secondary energy sector such as:

- S1: A subsidy on captured emissions is implemented. It develops CCS and BECCS. It is financed by a lump sum transfer from consumer.
- S2: A two-part instrument or a tradable allowance system is used to develop CCS and BECCS. The carbon tax rate is equivalent to the subsidy rate . Net revenues are returned to consumers as a lump sum transfer.
- S3: A carbon tax is implemented. Revenues are recycled to subsidize biomass emissions captured with CCS.
- S4: A carbon tax is implemented. Revenues are returned to consumers as a lump sum transfer.

Long term results

- Calibration of the model with world data for 2005.
- We can compare the cost of achieving the given emissions reduction using our instrument in terms of economic welfare variation (intertemporal utility variation). The economic welfare function is:

$$W = \sum_{t=0}^{\infty} \frac{1}{(1+\rho)^t}(U(C_t))$$

- The initial steady state (W_i) and the final steady state (W_f) values of the utility can therefore be computed. The intertemporal welfare variation is given by:

$$(\frac{W_f - W_i}{W_i}) * 100$$

Long term results

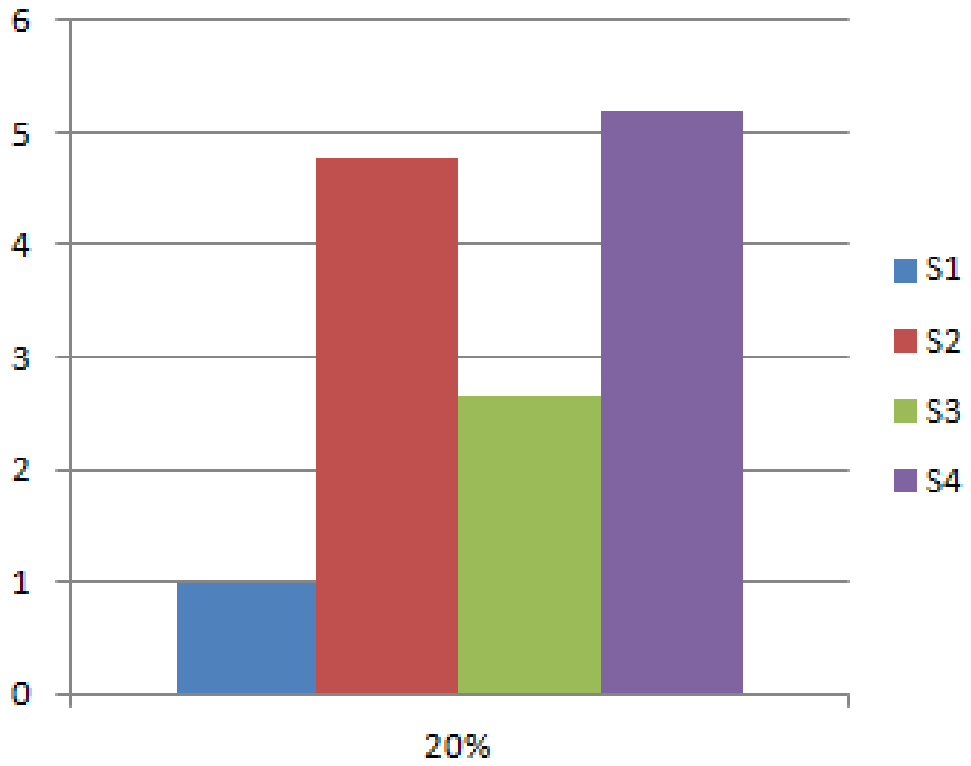
Shocks/Variables	S1 s^{ccs}=s^{bccs} =61.8	S2 t^{c}=s^{bccs} =22	S3 t^{c}=12 s^{bccs}=258	S4 t^{c}=22.9
Biomass demand	0.001	0.976	2.784	1.000
Fossil demand	3.994	-12.929	-7.800	-13.422
Sec. energy demand	1.016	-3.031	-0.219	-3.161
Output	0.102	-0.309	-0.022	-0.322
Investment	0.102	-0.309	-0.022	-0.322
Consumption	0.0048	-0.072	-0.022	-0.0766
Biomass price	-0.520	1.430	-0.803	1.499
Fossil price	-1.860	6.561	2.877	6.842
Sec. energy price	-0.904	2.807	0.197	2.932
Fossil resource price	10.259	-29.298	-18.392	-30.222
Wages	0.102	-0.309	-0.022	0.322
Economic welfare	-0.0004	-0.0019	-0.0010	-0.00204

Long term results

CCS and BECCS deployment (captured emissions %)

	S1	S2	S3	S4
CCS	22%	8%	4%	8%
BECCS	16%	6%	65%	0%

Relative cost of instruments (ratio)



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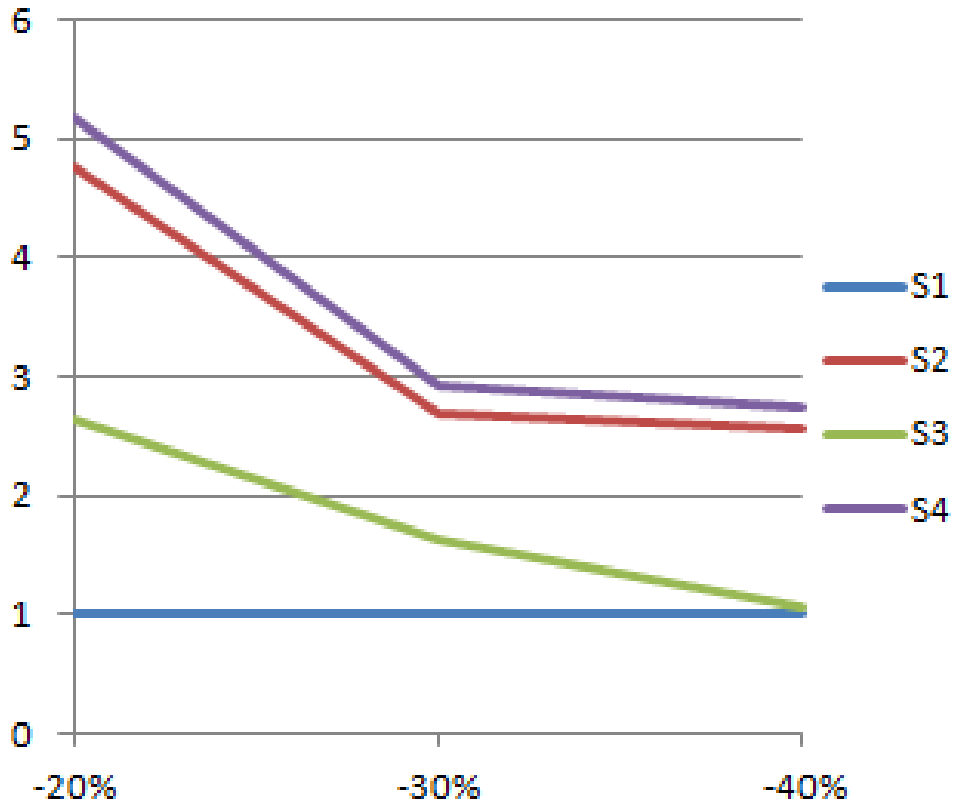

Conclusion

- Main results:
  - Only a specific subsidy on captured emissions from biomass will increase the deployment of BECCS
  - A specific subsidy is the most welfare improving instrument. However it has the disadvantage of encouraging the use of fossil fuel
  - It is less costly to use a carbon tax and to recycle its revenues to subsidize BECCS than to create a two part instrument or a cap and trade system that recognizes negative emissions
- Limits of the model
  - There is a substantial uncertainty regarding the parameters that determine the cost of BECCS technologies.
  - Policy recommandations are therefore pertinent if a global policy based on a unique carbon price is assumed